

Work Order ID 135160

July 31, 2015 11:11:43 AM

WIR

15.08.10

135160

Page 1

Item ID: D350-748-143TRN

Accept

N900040100

Setup Start *NS1*

Revision ID:

Stop *NS2*

Item Name: SS Crosstube Turning Detail

Start Date: 7/31/2015 Start Qty: 1.00

1

Cust Item ID:

Required Date: 8/14/2015 Req'd Qty: 1.00

1

Customer:

Reference:

20150731

Approvals: Process Plan: SU

Date:

Tooling:

Date:

Run Start *NR1*

QC:

Date:

SPC (Y/N):

Date:

Stop *NR2*

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
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Draw Nbr	Revision Nbr
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D350-748-143	A
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100

0.00

100

MORI SEIKI CNC LATHE LARGE

Mori Seiki

Memo

0.02

Mori Seiki CNC Lathe Large

1-Fill tube with sand & install plugs on both ends as per Folio

2-Turn first side as per Folio

3- File transition lines smooth

FOLIO REV: AA

DWG REV: AA

1-0

mml
15/08/10

110

QC1- Inspection performed by CMM

0.00

110

QC

Memo

0.00

Quality Control

1-0

mml
15/08/11

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____	DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐	AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐			
Date :	Step #:	QTY Effective :		MRB (QSI042) Approval	
Description Work Order Deviation		Disposition		Completed By	
				Lead hand / Supervisor Approval Verification	
				QC / QA Coordinator Approval	
Root Cause		FAULT CATEGORY			
Environment ☐ Design ☐ Doc/Data ☐ Equip/Tooling ☐ Handling/Pre ☐ Material ☐ Internal Transport ☐ Tribal Knowledge ☐ LOA ☐ Substation ☐ Past Expiry Date ☐ Misidentified ☐	No Re-verification ☐ Operator ☐ Offset/Setup ☐ Supplier ☐ Training ☐ Use for Testing ☐ Poor Information ☐ Rushing ☐ Product Improvement ☐ Process Improvement ☐ Manufacturing Process ☐ Past Due ☐	Pressure/Forced ☐ Bending ☐ Centre Not Concentric ☐ Cracks ☐ Crimp/Kink/Ripple/Wave ☐ Cuffs ☐ Crushing ☐ Heat Treat ☐ Wave/Twist in Tube ☐ Marks/Chatter ☐	Temperature/Cure ☐ Set-up ☐ BOM/Route ☐ Broken/Damage/Defect ☐ Inspection Incomplete/Unqualified ☐ Contamination ☐ Countersink ☐ Cut Too Short ☐ Instructions Incomplete/Unclear ☐ Drill Holes ☐	Power Loss/Surge ☐ Folio/Program ☐ Grain ☐ Weld ☐ Wrong Stock Pulled ☐ Out of Sequence ☐ Off-set ☐ Misabeled ☐ Fit/Function ☐ Misaligned/off center ☐	Positioned Wrong ☐ Outside Dimensions ☐ Over/Under tolerance ☐ Part Incorrect ☐ Part Lost/Missing ☐ Part Moved ☐ Drawing ☐ Finish ☐ Misread ☐ Turning Sequence ☐
OTHER : _____					

Work Order ID 135160***135160***

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NS1

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NS2

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Approvals:

Process Plan:

Date:

Tooling:

Date:

Run Start

NR1

QC:

Date:

SPC (Y/N):

Date:

Stop

NR2

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
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120

0.00

120

MORI SEIKI CNC LATHE LARGE

Mori Seiki

Memo

0.04

Mori Seiki CNC Lathe Large

1-Turn second side as per Folio _____
2- File transition lines smooth.
3-Scribe Part & Batch as per Dwg D350-748-143
FOLIO REV: AA
DWG REV: 9

130

0.00

130

QC1- Inspection performed by CMM

QC

Memo

0.00

Quality Control

140

0.00

140

QC8- Inspect parts - second check

QC

Memo

0.00

Quality Control

mmk
15/08/12

mmk
15/08/12

P.T.O. →

DAS
47
9-89
15-09-17

DQA:

Date: 15/09/28



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed

Date: 15/09/22

Work Order update only ☐

Work Order: <u>135160</u> Part No. <u>D380-748-143TR0</u> NCR No. <u>15-5357</u>	DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☒ Suspected Unapproved ☐	AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☒ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐			
Date: <u>1509-16</u>	Step #: <u>120</u>	QTY Effective: <u>①</u>		MRB (QSI042) Approval INSP 12 <u>CP</u> 15/9/16	
Description Work Order Deviation		Disposition		Completed By INSP 12 <u>CP</u> 15/9/16	
Mechanical failure led to one Cuff Being too short, Cuff length under tol, as well as the adjacent measurement. See Drawing.		Acceptable, taper is shifted outboard by 0.16". Tube is negligibly stronger.		Lead hand / Supervisor Approval Verification DAS 47 9-89 <u>9-09/17</u>	
QC / QA Coordinator Approval DAS 9 9-89 <u>15-09-16</u>					
Root Cause Environment ☐ Design ☐ Doc/Data ☐ Equip/Tooling ☒ Handling/Pre ☐ Material ☐ Internal Transport ☐ Tribal Knowledge ☐ LOA ☐ Substation ☐ Past Expiry Date ☐ Misidentified ☐ No Re-verification ☐ Operator ☐ Offset/Setup ☐ Supplier ☐ Training ☐ Use for Testing ☐ Poor Information ☐ Rushing ☐ Product Improvement ☐ Process Improvement ☐ Manufacturing Process ☐ Past Due ☐		FAULT CATEGORY Pressure/Forced ☐ Bending ☐ Centre Not Concentric ☐ Cracks ☐ Crimp/Kink/Ripple/Wave ☐ Cuffs ☐ Crushing ☐ Heat Treat ☐ Wave/Twist in Tube ☐ Marks/Chatter ☐ Temperature/Cure ☐ Set-up ☐ BOM/Route ☐ Broken/Damage/Defect ☐ Inspection Incomplete/Unqualified ☐ Contamination ☐ Countersink ☐ Cut Too Short ☐ Instructions Incomplete/Unclear ☐ Drill Holes ☐ Power Loss/Surge ☐ Folio/Program ☐ Grain ☐ Weld ☐ Wrong Stock Pulled ☐ Out of Sequence ☐ Off-set ☐ Misabeled ☐ Fit/Function ☐ Misaligned/off center ☐ Positioned Wrong ☐ Outside Dimensions ☐ ☒ Over/Under tolerance Part Incorrect ☐ Part Lost/Missing ☐ Part Moved ☐ Drawing ☐ Finish ☐ Misread ☐ Turning Sequence ☐			
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Item Name: SS Crosstube Turning Detail

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Cust Item ID:

Required Date: 8/14/2015 Req'd Qty: 1.00 ***1***

Customer:

Reference:

Approvals: Process Plan: _____ Date: _____ Tooling: _____ Date: _____

Run Start ***NR1***

QC: _____ Date: _____ SPC (Y/N): _____ Date: _____

Stop ***NR2***

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
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150

0.00

150

Large Fab

Crosstubes

Memo

0.01

Crosstubes

1-Grind machining marks

BL 15/09/17

190

0.00

190

Packaging

Packaging

Memo

0.00

Packaging

Identify and stock in kanban rack
Location: L4 003

BL 15/09/17

200

QC21- Final Inspection - Work Order Release

0.00

200

QC

Memo

0.00

Quality Control

ML5 SEP 21 2015

ML5 SEP 21 2015

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____		DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐		AGAINST DEPARTMENT/PROCESS <table style="width:100%; border: none;"> <tr> <td style="width:15%;">Skid-tube ☐</td> <td style="width:15%;">Cross tube ☐</td> <td style="width:15%;">Water Jet ☐</td> <td style="width:15%;">Engineering ☐</td> </tr> <tr> <td>Machining ☐</td> <td>Small Fab ☐</td> <td>Prod. Eng. Coord. ☐</td> <td>Quality ☐</td> </tr> <tr> <td>Thermoforming ☐</td> <td>Finishing ☐</td> <td>Rec/Store/Packaging ☐</td> <td>Other ☐</td> </tr> <tr> <td>Large Fab ☐</td> <td>Composite ☐</td> <td>Supplier ☐</td> <td></td> </tr> </table>						Skid-tube ☐	Cross tube ☐	Water Jet ☐	Engineering ☐	Machining ☐	Small Fab ☐	Prod. Eng. Coord. ☐	Quality ☐	Thermoforming ☐	Finishing ☐	Rec/Store/Packaging ☐	Other ☐	Large Fab ☐	Composite ☐	Supplier ☐																																					
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Picklist Print

July 31, 2015 11:11:47 AM

Page 1

Work Order ID: 135160

135160

Parent Item: D350-748-143TRN

D350-748-143TRN

Parent Item Name: SS Crosstube Turning Detail

Start Date: 7/31/2015

Required Date: 8/14/2015

Start Qty: 1.00

Required Qty: 1.00

Comments: NEW ISSUE - PRELIM - LL 12.05.08

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6021-125		Manufactured	No				Each	103.0000		1			

D6021-125

Crosstube Material - 17-4Ph SS

<u>Location</u>	<u>Loc Qty</u>	<u>Loc Code</u>
HALL	71	
127271	35	
127272	16	
85076	20	
LG	32	
127272	32	

_____ 1 mm L 15/08/10

Item	Qty -143	Part Number	Description
	X	D350-748-143	CROSSTUBE ASSEMBLY (AS 350/355 HI FWD)
1	1	D6021-125	CROSSTUBE
2	2	D3502-1	SUPPORT
3	2	D5123-7	CLAMP CUSHION
4	1	AETC-1032	INSERT
5	2	MS21920-20 OR MS21920-21/-22	CLAMP (PER DART SPEC. M-MS21920-20/-21/-22)
6	1	NAS1149C0363R	WASHER (OR AN960C10)
7	1	NAS1635-3-8	SCREW (OR MS51958-63)
8	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6021-125 (17-4PH)
FINISHED LENGTH AFTER TURNING = 112.270±0.06 (AFTER BENDING/TRIMMING = 110.27 REF)
- 2) FINISH: PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED.
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-143" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 30.45 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.290 HOLE.
- 9) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

TURNING

- 10) BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER BENDING.

BENDING

- 11) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES PER SIDE. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D. ON TOP HALF OF BEND, AND 8% ON BOTTOM HALF OF BEND.
- 12) MAX AMPLITUDE OF RIPPLING ALONG BENT PORTION OF THE TUBE IS 0.030 (ZN A1-3)
- 13) MAX TWIST: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

ASSEMBLY

- 14) TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- 15) TORQUE CLAMPS 60 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

RELEASED

2015 MAR 18

Q EN 15-547

135160

SA 20150907

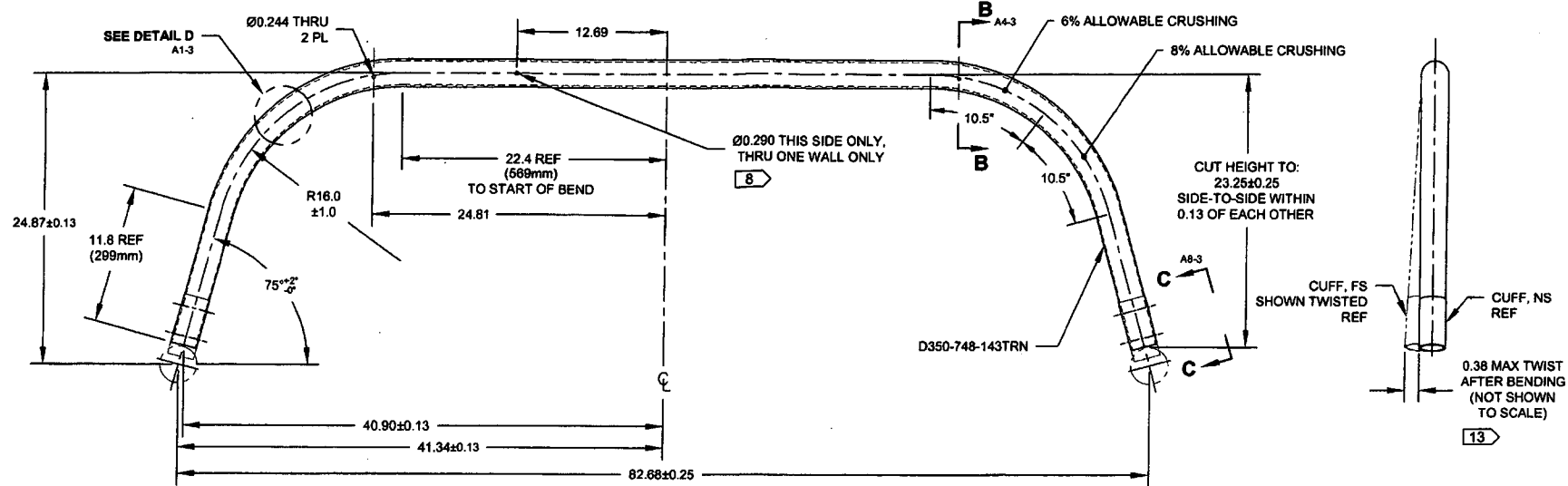
UNDER REVIEW

Q 15/4/24

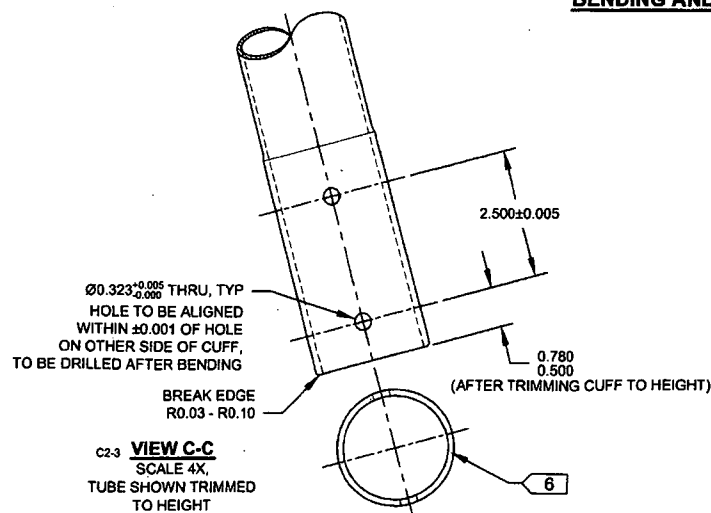
GRF 15-561

A	NEW ISSUE	CP	15.01.21
REV.	DESCRIPTION	BY	DATE
DESIGN	Q		
DRAWN	Q		
CHECKED	A.P.		
MFG. APPR.	24		
APPROVED	3		
DE APPR.			
DATE	15.01.21		

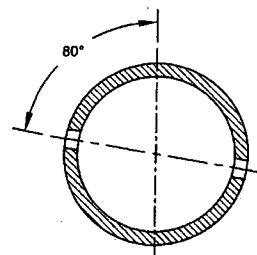
DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
DRAWING NO. D350-748-143	REV. A SHEET 1 OF 4
TITLE CROSSTUBE (AS 350/355 HI FWD)	SCALE NTS
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D350-748-143
BENDING AND DRILLING DETAIL 11



VIEW C-C
SCALE 4X,
TUBE SHOWN TRIMMED
TO HEIGHT



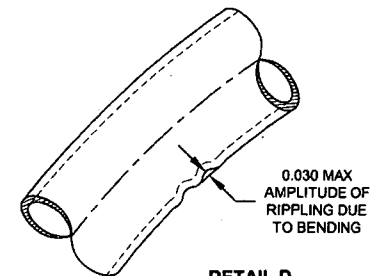
SECTION B-B D3-3
SCALE 6X

RELEASED

2015 MAR 18

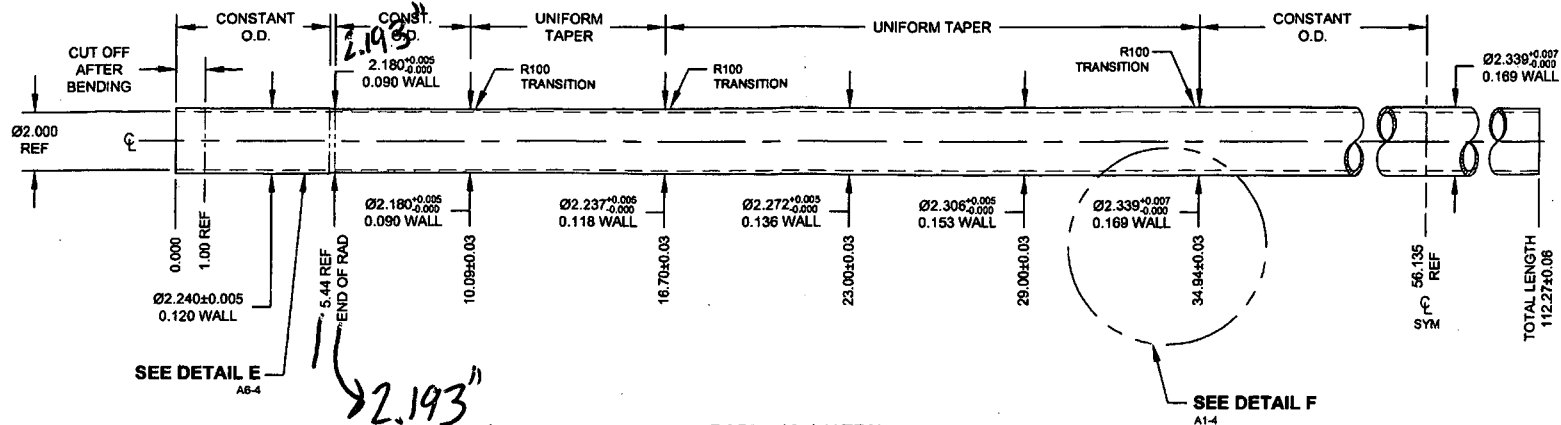
UNDER REVIEW

15/4/28



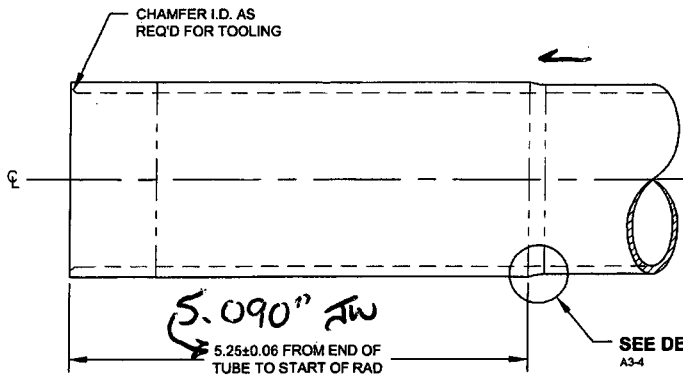
DETAIL D D7-3
SCALE 4X
RIPLEING EXAGGERATED

DESIGN		DART AEROSPACE LTD	
DRAWN		HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. A
MFG. APPR.		D350-748-143	SHEET 3 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	15.01.21	COPYRIGHT © 2015 BY DART AEROSPACE LTD	
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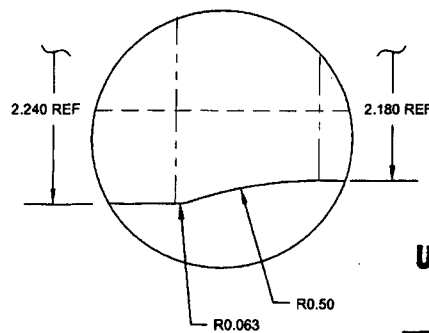


**D350-748-143TRN
TURNING DETAIL**

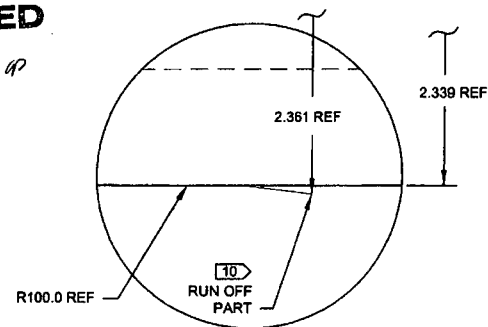
RELEASED
2015 MAR 18 *AP*



**DETAIL E:
CROSSTUBE CUFF** C7-4
SCALE 3X



**DETAIL G:
CUFF TRANSITION** A5-4
NOT TO SCALE



**DETAIL F:
TOOL RUN-OFF** C3-4
NOT TO SCALE

UNDER REVIEW
18/4/21

DESIGN	<i>AP</i>	DART AEROSPACE LTD	
DRAWN	<i>AP</i>	HAWKESBURY, ONTARIO, CANADA	
CHECKED	<i>AP</i>	DRAWING NO.	REV. A
MFG. APPR.	<i>AP</i>	D350-748-143	SHEET 4 OF 4
APPROVED	<i>AP</i>	TITLE	SCALE
DE APPR.	<i>AP</i>	CROSSTUBE (AS 350/355 HI FWD)	NTS
DATE	15.01.21	COPYRIGHT © 2015 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	

DART AEROSPACE LTD		Work Order:	135160
Description: Crosstube Assembly (AS350/355 High Fwd)		Part Number:	D350-748-141
Inspection Dwg: D350-748-141 Rev: N A mml		Page 1 of 2	

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mml

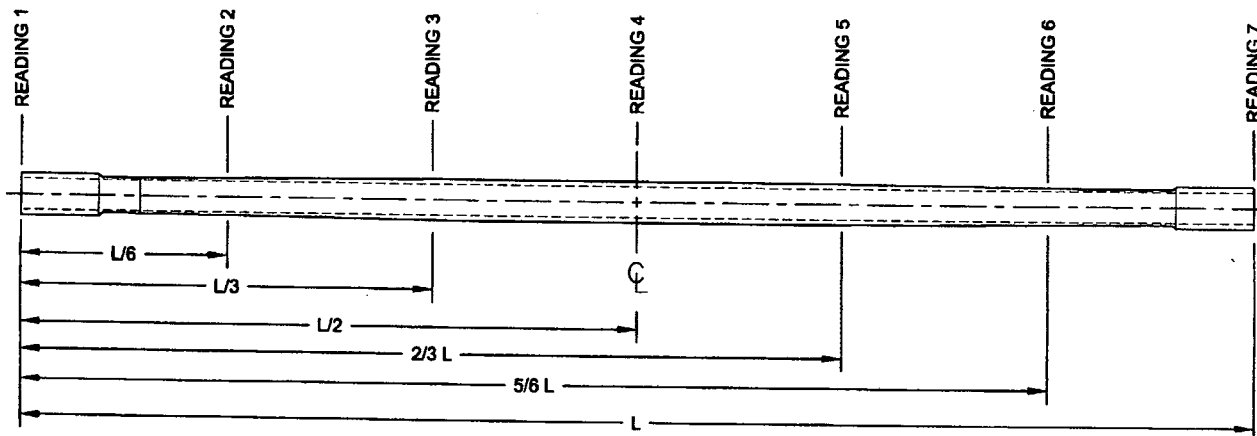
FIRST ARTICLE INSPECTION CHECKLIST

Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+0.005/-0.000	2.242	-	vern	CNC-08
	2.180	+0.005/-0.000	2.182	-	↓	
	2.180	+0.005/-0.000	2.183	-		
	2.237	+0.005/-0.000	2.240	-		
	2.272	+0.005/-0.000	2.273	-		
	2.306	+0.005/-0.000	2.308	-		
	2.339	+0.007/-0.000	2.343	-		
	2.339	+0.007/-0.000	2.344	-		
	0.062	+/-0.010	.062	-	vern	CNC-08
	5.25	+/-0.060	5.25	-	"	
	R0.063	+/-0.010	.063	-	R6	
	R0.50	+/-0.030	.500	-	"	
SIDE B	2.240	+0.005/-0.000	2.245	-	vern	CNC-08
	2.180	+0.005/-0.000	2.188	-	↓	
	2.180	+0.005/-0.000	2.186	-		
	2.237	+0.005/-0.000	2.242	-		
	2.272	+0.005/-0.000	2.275	-		
	2.306	+0.005/-0.000	2.309	-		
	2.339	+0.007/-0.000	2.343	-		
	2.339	+0.007/-0.000	2.342	-		
	0.062	+/-0.010	.062	-	vern	CNC-08
	5.25	+/-0.060	2.060	fail	"	
	R0.063	+/-0.010	.063	-	R6	
	R0.50	+/-0.030	.500	-	"	
	112.27	+/-0.060	112.27	-	tape	LG-11

DART AEROSPACE LTD		Work Order: 135160
Description: Crosstube Assembly (AS350/355 High Fwd)		Part Number: D350-748-141
Inspection Dwg: D350-748-141 Rev: N A m m L		Page 2 of 2

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amml

WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L= 0"	.133	.130	.124	.126	.009	0.030"
READING 2 L= 19	.134	.133	.132	.136	.004	
READING 3 L= 37	.175	.176	.178	.177	.003	
READING 4 L= 56	.172	.174	.179	.176	.006	
READING 5 L= 75	.174	.177	.180	.177	.006	
READING 6 L= 93	.131	.135	.133	.128	.007	
READING 7 L= 112	.128	.128	.124	.127	.004	

Calibration Result

Actual Block Thickness: .100 - .750

DAS Sitescan 250 Measured Thickness: .100 - .750

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Measured by: amml
Date: 15/08/12

Audited by: 9-89
Date: 15-09-17

Preliminary Approval:
Date:

Rev	Date	Change	Revised by	Approved
C	11.01.20	Dwg Rev updated (P/O D350-748-101)	KJ	
D	11.07.26	Tolerance revised for 2.339 dimensions	KJ	
E	12.06.04	Wall thickness form added	KJ	
F	13.05.08	Dimension 112.27 was 110.27	KJ	
G	14.04.25	5.25 dimension revised to 5.25	KJ	
H	15.04.14	Dwg Rev updated	KJ	